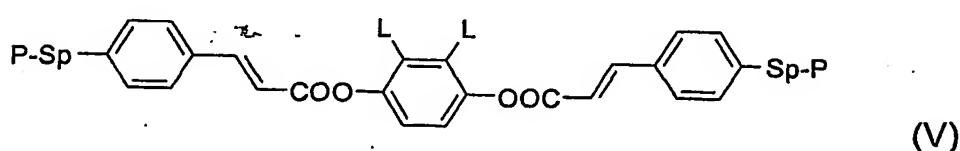
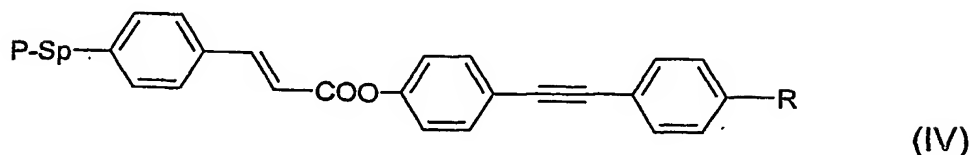
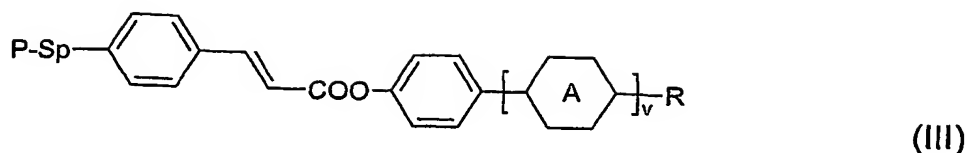


Patent Claims

- 5 1. Film comprising a polymerised liquid crystal (LC) material comprising at least one photoisomerisable compound, characterized in that said film comprises at least two regions with different retardation and/or at least two regions with different orientation of the LC material.
- 10 2. Film according to claim 1, characterized in that it comprises at least two regions with different retardation of the LC material.
- 15 3. Film according to claim 1 or 2, characterized in that it is obtained by polymerisation or crosslinking of a polymerisable LC material comprising at least one polymerisable and photoisomerisable compound.
- 20 4. Film according to at least one of claims 1 to 3, characterized in that the orientation of the LC material is controlled by varying the irradiation time and/or intensity of the photoradiation used to cause photoisomerisation in the LC material.
- 25 5. Film according to at least one of claims 1 to 4, characterized in that the polymerisable LC material comprises one or more photoisomerisable compounds selected from azobenzenes, benzaldoximes, azomethines, stilbenes, spiropyrans, spirooxadines, fulgides, diarylethenes, cinnamates, 2-methyleneindane-1-ones and (bis-)benzylidenecycloalkanones.
- 30 6. Film according to claim 5, characterized in that the polymerisable LC material comprises one or more photoisomerisable compounds selected from polymerisable mesogenic cinnamates.
- 35 7. Film according to at least one of claims 1 to 6, characterized in that the polymerisable LC material comprises one or more photoisomerisable compounds selected from the following formulae

- 35 -



wherein

A is 1,4-phenylene or 1,4-cyclohexylene,

P is a polymerisable group,

Sp is a spacer group or a single bond,

R is a polar group or an unpolar alkyl or alkoxy group with up to 15 C atoms,

L is in each occurrence independently H, F, Cl, CN or an optionally halogenated alkyl, alkoxy, alkylcarbonyl, alkoxy carbonyl or alkoxy carbonyloxy group with 1 to 7 C atoms, and

v is 0 or 1.

and wherein the phenylene rings are optionally mono- di-, tri- or tetrasubstituted by L.

8. Film according to at least one of claims 1 to 7, characterized in that the polymerisable component of the polymerisable LC

material comprises at least 12 mol % of photoisomerisable compounds.

- 5 9. Film according to claim 8, characterized in that the polymerisable component of the polymerisable LC material comprises from 40 to 100 mol% of photoisomerisable compounds.
- 10 10. Film according to claim 8, characterized in that the polymerisable component of the polymerisable LC material comprises 100 % of photoisomerisable compounds.
11. Polymerisable LC material according to at least one of claims 8 to 10.
- 15 12. Patterned film comprising polymerised liquid crystal (LC) material, characterized in that it comprises at least two regions with different retardation and at least two regions with different orientation of the LC material.
- 20 13. Method of preparing a film according to at least one of claims 1 to 12, comprising the following steps:
- 25 a) providing a layer of a polymerisable LC material comprising at least one photoisomerisable compound onto a substrate,
b) aligning the layer of LC material into planar orientation,
c) exposing the LC material in the layer, or in selected regions thereof, to photoradiation that causes isomerisation of the isomerisable compound,
30 d) polymerising the LC material in at least a part of the exposed regions the material, thereby fixing the orientation, and
e) optionally removing the polymerised film from the substrate.,
14. Method according to claim 13, characterized in that the retardation and/or orientation of the LC material is controlled by
35 varying the amount and/or type of the photoisomerisable

compound, and/or by varying the intensity of the photoradiation and/or the exposure time.

5 15. Method of preparing a multilayer comprising at least two layers of polymerised LC material having different orientation, comprising the following steps:

- 10 A) providing a first layer of a polymerisable LC material comprising at least one photoisomerisable compound onto a substrate,
- B) aligning the first layer of LC material into planar orientation and polymerising the material, thereby fixing the orientation,
- 15 C) providing a second layer of LC material as described in steps A) and B), wherein the first layer serves as substrate,

20 wherein the LC material in at least one of said first and second layers; or in selected regions thereof, before polymerisation is exposed to photoradiation that causes isomerisation of the isomerisable compound.

25 16. Method according to at least one of claims 13 to 15, characterized in that the LC material is exposed to radiation that causes photoisomerisation and photopolymerisation, and photoisomerisation is carried out in the presence of oxygen and photopolymerisation is carried out in the absence of oxygen.

17. Film or a multilayer obtained by a method according to at least one of claims 13 to 16.

30 18. Film or a multilayer according to at least one of claims 1 to 17, characterized in that it comprises at least one region having planar orientation and at least one region having splayed orientation.

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19. Multilayer according to claim 17 or 18, characterized in that it comprises at least one layer having planar orientation and at least one layer having splayed orientation.
- 5 20. Multilayer according to claim 17 or 18, characterized in that it comprises at least one layer having splayed orientation and at least one region having homeotropic orientation.
- 10 21. Use of a film or multilayer according to at least one of claims 1 to 20 in liquid crystal displays (LCDs) or other optical or electrooptical components devices, for decorative or security applications, as alignment layer, optical retardation film or optical waveguide.
- 15 22. Patterned film comprising at least two regions having different retardation for use as optical retardation film in an active matrix colour LCD.
- 20 23. LCD comprising an optical retardation film according to at least one of claims 1 to 22.
- 25 24. Use of a film according to at least one of claims 1 to 22 as optical retardation film in an LCD, characterized in that the film is positioned between the substrates of the switchable LC cell.
- 30 25. LCD comprising an LC cell formed by two plane parallel substrates at least one of which is transparent to incident light, an electrode layer provided on the inside of at least one of said two transparent substrates and optionally superposed with an alignment layer, and an LC medium located between the two substrates that is switchable between at least two different states by application of an electric field, characterized in that the LCD comprises at least one film according to at least one of claims 1 to 22 that is positioned between the two plane parallel substrates forming the LC cell.
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26. LCD comprising

1) a liquid crystal (LC) cell comprising the following elements, starting from the edges to the centre of the cell in the sequence listed below

11) a first and a second substrate plane parallel to each other, at least one of which is transparent to incident light,

12) an array of nonlinear electric elements on one of said substrates which can be used to individually switch individual pixels of said LC cell, said elements being preferably active elements like transistors, very preferably TFTs,

13) a colour filter array provided on one of said substrates, preferably on the substrate opposite to that carrying the array of nonlinear elements, said colour filter optionally being covered by a planarisation layer,

14) a first electrode layer provided on the inside of said first substrate,

15) optionally a second electrode layer provided on the inside of said second substrate,

16) optionally first and second alignment layers provided on said first and second electrodes,

17) an LC medium that is switchable between at least two different states by application of an electric field,

2) a first linear polariser on one side of the LC cell,

3) optionally a second linear polariser on the side of the LC cell opposite to that of the first linear polariser, and

4) at least one optical retardation film according to at least one of claims 1 to 22,

characterized in that said optical retardation film 4) is situated between the colour filter and the LC medium.

5 27. LCD according to claim 26, characterized in that the colour filter has a pattern of different pixels transmitting one of the primary colours red, green and blue (R, G, B), and the optical retardation film exhibits a pattern of pixels with three different retardations, each of which is adjusted such that its efficiency of converting linearly polarised light into circularly polarised light is optimised for one of the colours R, G and B, and the optical retardation film is positioned on the colour filter such that each R-, G- or B-pixel of the colour filter is covered by a corresponding pixel of the optical retardation film having a retardation optimised for this colour.

15 28. Optical waveguide comprising a film according to at least one of claims 1 to 22.

20 29. Optical waveguide according to claim 28, characterized in that has constant thickness and a refractive index gradient wherein the refractive index continuously decreases in a direction parallel to the film plane from one edge of the waveguide to its opposite edge.

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